

REMARKS

I. Introduction

Claims 1-17 are pending and stand rejected. Claims 18-23 were previously canceled.¹ With this response, claims 1-17 are amended and claim 24 is added. Consequently, claims 1-17 and 24 are at issue. Claims 1, 5, 9, 13, and 24 are the only independent claims.

II. The Rejections

The objections to the specification and the §112 rejections

The disclosure was objected to because the examiner contended that the specification did not contain a sufficient amount of information to implement the claimed device. Claims 1-17 were rejected under 35 U.S.C. §112, second paragraph as being indefinite. These objections and rejections are obviated for the reasons stated below.

The §103 rejections

Claims 1-6, 9-11, and 18-33 were rejected under 35 U.S.C. §103(a) as being unpatentable over applicant's admitted prior art (FIG. 1) and U.S. Patent No. 5,646,991 to Sih. Claims 13-17 were rejected under 35 U.S.C. §103(a) over U.S. Published Application No. US20040078104 to Nguyen in view of applicant's admitted prior art and Sih, and further in view of U.S. Patent No. 6,891,954 to Takahashi. Claims 7 and 8 were rejected under 35 U.S.C. §103(a) as being unpatentable over applicant's admitted prior art in view of Sih and Takahashi. Claim 12 was rejected under 35 U.S.C. §103(a) as being unpatentable over Nguyen in view of applicant's admitted prior art in view of Sih and further in view of U.S. Patent No. 6,122,506 to Lau. These rejections as they may apply to the claims presented herein are respectfully traversed.

¹ The Applicant notes that the body of the Office Action (See, e.g., see page 4, point 5) still makes substantive rejections as to claims 18-23. The Applicant assumes this to be an error and that no rejections of these cancelled claims are intended.

III. The prior art

Applicant's admitted prior art

Applicant discloses as prior art in FIG. 1 a cascaded echo-canceler arrangement. As shown below for the convenience of the Examiner, a first echo canceler filter 80 feeds into a second echo canceler adaptive filter 84. The output of this arrangement feeds into noise suppression logic 20. Thus, noise is removed only after data is processed by both echo canceler filters. As explained in applicant's specification (paragraph 11) the noise suppression logic 20 receives (as part of the final post echo canceler uplink data) the noise modulation of the background noise. As a result, the end user will receive the final data containing annoying background noise artifacts. Since the adaptive filters 80 and 84 use weighted coefficients and feed directly to the noise suppression logic 20, the noise suppression logic is directly affected by the coefficient generators.

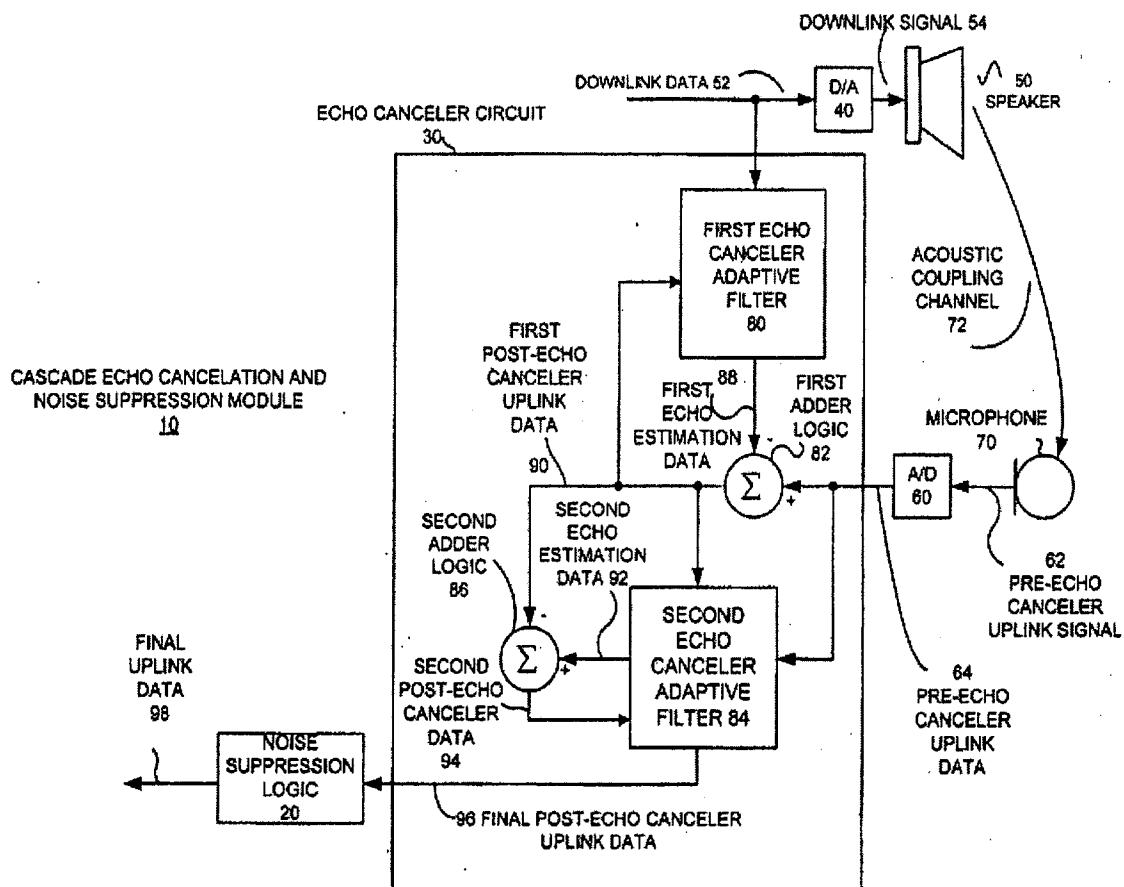


FIG. 1 (PRIOR ART)

Sih

Sih describes a noise replacement system and method for providing a synthesized noise replacement signal to an output speech channel in an echo cancellation system. As shown in his FIG. 5 (reproduced below for the convenience of the Examiner) a high pass filter 146 removes “low frequency background noise.” Sih, col. 9, 17-30. This is summed at summer 148 with an echo canceler signal $y_i(n)$ to create an echo residual signal $e(n)$. Noise analysis unit 166 analyzes $e(n)$ and provides an analysis to noise synthesis unit 168. The output is either $e(n)$ or a synthesized noise signal $s(n)$. Sih, col. 10, lines 16-31. The filter 146 is not randomly placed; instead, it receives as its input the output of the echo canceler stage. See, Sih FIG. 5, output of element 144. When only the far end speaker is talking, echo is rejected by replacing the echo residual signal $e(n)$ with synthesized noise. In other words, in many circumstances noise is created by the Sih system, not removed from it.

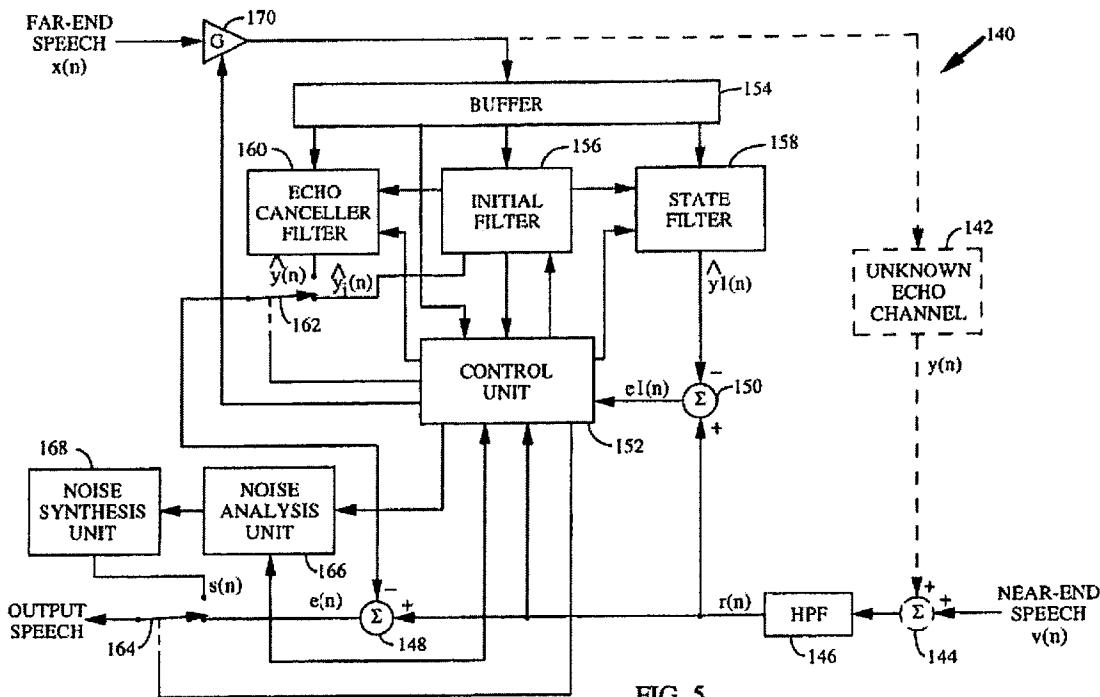


FIG. 5

Takahashi

Takahashi describes a noise reduction system in a vehicle. As far as the applicant can tell, Takahashi does not involve echo cancellation.

Nguyen

Nguyen involves an in-car audio system. Nguyen does not disclose the use of an echo canceler. See Nguyen, abstract.

Lau

Lau involves a GPS/GSM receiver. As far as applicant can tell, Lau does not involve either noise reduction or echo cancellation.

IV. The claim amendments

The applicant has made numerous amendments to the claims presented herein. The applicant submits that the amended claims are fully supported by the specification.

Turning now to the claims, claim 1 recites receiving data and linearly filtering the data to produce pre-noise suppression data. Among other places, the applicant submits that this language is supported at FIG. 2 and paragraphs 11 and 24 of the specification.

Claim 1 also recites removing noise from the pre-noise suppression data to provide noise suppressed data. The applicant submits that this language is supported at paragraphs 22 and 45 of the specification, among other places.

Claim 1 further recites dynamically determining at least one weighted filter coefficient using at least in part the pre-noise suppression data and not the noise suppressed data, the determining occurring independently from and not being affected by removing the noise from the pre-noise suppression data. The applicant submits that among other places this language is supported at paragraphs 22 and 45 of the specification.

Claim 1 also recites that removing the noise occurs independently from and is not affected by dynamically determining the at least one weighted coefficient such that the noise is removed without encountering an artificial variation in a noise floor. Among other places, the applicant submits that this language is supported at paragraphs 22 and 45 of the specification. Also, see FIG. 2 and the lack of interaction between the noise suppression logic 212 and the filter coefficient data generator 220.

Claim 1 additionally recites subsequently filtering echoes from the noise suppressed data using the at least one weighted filter coefficient to produce final data, the final data being

substantially free of noise and substantially free of echoes. Among other places, the applicant submits that this language is supported at paragraphs 21, 22, 31 and 45 of the specification.

The other independent claims have recitations similar to claim 1. It is submitted that these claims and their elements are supported by the specification for the same reasons as those given above with respect to claim 1.

Applicant's approaches are advantageous because the noise suppression function is not influenced or affected by the filter coefficient generation function and vice versa. Among other advantages, this assures that removing the noise is accomplished without encountering an artificial variation in a noise floor. This advantage, in turn, provides an output signal that is substantially free of echoes or noise and avoids the problems of previous approaches such as those that are configured in cascaded arrangements.

V. The Claims are allowable

The objections to the specification and §112 rejections are obviated because of the claim amendments

As mentioned, the Examiner made various objections to the specification and rejections of the claims under §112. The applicant has described in detail how the amended claims are fully supported by the specification. As such, it is respectfully submitted that the objections to the specification and §112 rejections to the claims are obviated.

The §103 rejections are traversed because none of the references teaches or suggests that noise reduction is accomplished independently from echo cancellation—indeed, if anything, the opposite is taught by the references

None of the references teach or suggest that removing the noise occurs independently from and is not affected by dynamically determining the at least one weighted coefficient such that the noise is removed without encountering an artificial variation in a noise floor as recited in claim 1. To the contrary, applicant's admitted prior art teaches the exact opposite: the determination of the weighted coefficients directly affects noise reduction since signals from the cascaded echo cancellers feed directly into the noise suppression logic 20. As for Sih, noise is synthesized (created) for long periods of Sih's system. This, in fact, is the opposite of applicant's approach where noise is continuously removed. Furthermore, although Sih does somewhat reduce some background noise under limited circumstances, this occurs after echo

cancellation and, consequently, the noise removal is directly affected by the echo cancellation and coefficient generation (see summer 144 where echo sign $y(n)$ is summed with the noise). The remaining references Takahashi, Nguyen, and Lau have nothing to do with echo cancellation or noise removal.

Since at least one element of claim 1 is not taught or suggested by any of the cited references, it is submitted that claim 1 is allowable over any combination of the cited references.

However, the Examiner suggested that “it would have been obvious to one of ordinary skill in the art... to implement a high pass filter noise suppressor [as in Sih] before or after either echo cancellation stage [of applicant’s admitted prior art] in order to remove a portion of the background noise.” The applicant respectfully disagrees with this assertion. As mentioned, the high pass filter in Sih is positioned after the echo canceler and, as such, noise removal is directly affected by echo cancelation (and coefficient generation).

Applicant’s admitted prior art also provides noise suppression after echo cancellation and, consequently, this noise removal is directly affected by echo cancellation (and coefficient generation). There is no reason to add additional noise reduction elements within or between these stages since some noise reduction already occurs (albeit imperfectly) at noise suppression logic 20. In any case, the applicant submits that modifying applicant’s admitted prior art as suggested would not result in removing the noise independently from and not being affected by the coefficient determination such that the noise is removed without encountering an artificial variation in a noise floor all as recited in claim 1. To the contrary, since the noise suppression logic 20 would remain in place even after the proposed modification was made, it would always be affected by the operation of the echo canceler filters (and their coefficient generation).

Consequently, any proposed modification to place a noise removal filter before an echo canceler in applicant’s admitted prior art is taught against by both references and would alter the operating principles of applicant’s admitted prior art. Such a modification represents a hindsight reconstruction of applicant’s claimed subject matter and, consequently, the proposed modification is not obvious for these reasons. The applicant submits that claim 1 is allowable for these additional reasons.

Independent claims 5, 9, and 13 have been amended in a manner similar to claim 1 and are submitted to be allowable for the same reasons as claim 1. New claim 24 has recitations similar to claim 1. The remaining claims depend directly or indirectly upon the independent

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claims. Since the independent claims are allowable, it is submitted that the dependent claims are also allowable.

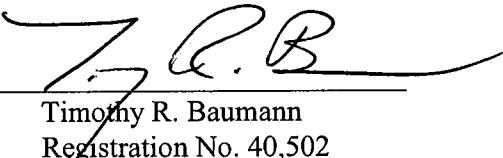
VI. Conclusion

If the Examiner should have any other points of concern, the Examiner is expressly invited to contact the undersigned by telephone to discuss those concerns and to seek an amicable resolution.

The Commissioner is hereby authorized to charge any additional fees which may be required in this application to Deposit Account No. 06-1135.

Respectfully submitted,

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